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# Regional Typology of Beekeeping and Consumption of Honeybee Products in Ukraine

By

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**Summary** : The history of beekeeping in Ukraine is more than 1000 years old, and has undergone many different challenges on its development path. Economic crises in independent Ukraine made household beekeeping production an important source of income, resulting therein that 98.9% of natural honey harvested in individual household apiaries represented 4.1% of country households in 2015. Beekeeping and processing practices are mostly traditional and are diversified by households and regions, based on the local agri-food culture. Principle component analysis and cluster analysis, using 11 variables from each of 25 regions, were undertaken to clarify the regional peculiarities of production practices and conditions. Three production region groups were defined as cluster 1 (the western part), cluster 2 (the central part), and cluster 3 (the south-eastern parts of the country). The region of cluster 1 is characterized by large forest areas and wild vegetation, and the area of melliferous agricultural crops and the number of household apiaries are the smallest of all the clusters. However, the price of honey sold by agricultural enterprises apiaries was the highest. In cluster 2, the area is a forest steppe zone and the agricultural economy has been developed. This cluster had the largest amount of honey produced by agricultural enterprises, but the price was the lowest. In cluster 3, agriculture and industry were highly developed, and honey productivity was the highest because of the largest area of melliferous crops. The results showed the necessity of a differentiated approach in the development of industry improvement measures through risk management, maintaining biocultural diversity, and agri-food culture in the country, as well as ecosystem services intensification. Research of consumers' behaviour for honeybee products showed that people consume not only honey but various types of products and 85% of respondents had access to those products from family and friends. Consumers believe information given by beekeepers about honey production area and honey variety, and are not concerned about the availability of a honey quality certificate for commodities.

**Key words** : beekeeping, consumption behavior, honey, principle component analysis, regional typology

## Introduction

Ukraine has enormous agricultural potential based on the largest agricultural area in Europe, nine times the Japanese total land area, with fertile black soil, so called the 'bread basket of Europe'. However, after gaining independence in 1991, Ukraine has not realized its potential, and the economy has not been stable. Beekeeping is recognized as an integral part of agriculture, employing a large number of households in the country in both urban and rural areas. This industry is under-researched

in the framework of differentiation by combining biological and economic factors. Regarding honeybee production, the main concerns are the low level of profitability for both household and enterprise apiaries, low purchasing power, the decreasing number of bee families (colonies), and insufficient advertisement of bee products<sup>1, 2)</sup>.

According to the World Bank, high-value product markets provide an important possibility for differentiating farming systems and explicating a competitive and labour-intensive smallholder sector<sup>3)</sup>. Developing industries is important in reducing rural-urban income disparities and

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in solving rural poverty issues. Recently, there has been increased attention to natural food, and the consumer's interest for honeybee products has similarly increased through the awareness of health and food safety issues. However, information related to Ukrainian beekeeping production and consumption is limited.

This study aims to clarify the characteristics of beekeeping in Ukraine to define and illustrate the regional typology of beekeeping nationwide, as well as consumers' behaviour regarding the bee products. Complex approaches to data analysis led to the development of production region typology. The purpose of the consumers' survey is to determine important criteria for the development of the honeybee business. A categorization would be useful in developing an appropriate approach to deepen industry research and create further development programs, as well as in business planning. Moreover, its solution would contribute to the design of the further development of the beekeeping industry, as well as to conserve the bio-cultural diversity and agri-food culture as the core of food sovereignty related to household honey production.

## History and Current Situation of Beekeeping

### (1) History of Beekeeping

One of the first mentions of beekeeping on modern Ukrainian territory was recorded in A.D. 945, and the forest beekeeping in Kyiv Rus developed during the 9th and 10th centuries. Honey and wax were used not only for domestic consumption, but were also exported to Byzantium, Europe, and Eastern countries, and played a key role in the country's economy<sup>4)</sup>.

The assembled book of laws of Kyiv Rus, 'Ruska Pravda', composed in the 11th–12th centuries, included very strict punishment for the deterioration or abduction of bee colonies. Honey was used for the treatment of disease, and propolis smoke was applied to treat lung diseases<sup>5)</sup>. At the end of the 17th–18th century in Europe and Ukraine, beekeeping had declined due to the development of industries related to trees and wood, and forest export: this decreased forest areas and therefore beekeeping resources as well. The development of wine production and the import of wines at the end of the 19th century from Bessarabia, Transcaucasia, drastically decreased the production of high-priced honey wines.

The invention of the first frame beehive by the Ukrainian beekeeper Petro Prokopovych in 1814 facilitated the spread of beekeeping to the different regions. The first beekeeping school in the Russian Empire and Europe was established in the Chernihiv region by Prokopovych in 1828. Beekeeping and bee products became popular, and beekeeping created a traditional agri-food culture.

In 1878, sugar beet sugar production in the Russian

Empire increased to 64,000 tons, and most of the sugar-producing facilities were located in Ukraine. Sugarcane imports and high self-production of beet sugar facilitated exports to other countries and decreased beekeeping as well as the production and usage of honey.

An economic crisis followed the independence of Ukraine in 1991, and that period of depression in the economy and in industry, including agriculture, negatively influenced the population's social conditions and income<sup>6)</sup>. The low income and high unemployment rate led people to seek additional income sources and to grow their own food<sup>7)</sup>. Household crop production and beekeeping developed and became a valuable source of the household economy. Beekeeping is recognized as household husbandry to feed the family and provide additional income. Even now, people can produce their own food for daily consumption at *dacha*-home gardens, and household agricultural production has a significant impact on the local, regional, and national economies.

### (2) Current Situation of Beekeeping in Ukraine

In 2015, Ukraine was the sixth largest honey-producing country in the world, following China, Turkey, Iran, USA, and the Russia Federation<sup>9)</sup>. The 2011 Ukrainian honey supply per capita was higher than that of other countries at 1.1 kg/year, while it was 0.3 kg in China and 0.6 kg in the USA. Production remained at approximately 35,000 tons/year in 1980 but has increased to 70,000 tons/year since 2005 (Fig. 1).

Ukrainian beekeeping is oriented toward crop pollination and honey production by apiaries of households and

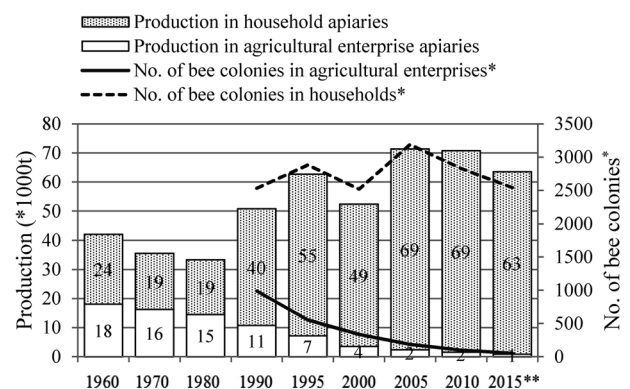


Fig. 1 Honey production and number of bee colonies in Ukraine

Source : State Statistics Service of Ukraine (2016)<sup>8)</sup>

Note : \*Number of bee colonies on January 1 of the next year. \*\*Indicated data for 2015 do not include data on production in temporarily occupied territories in AR Crimea and Sevastopol city or the territory of antiterrorist operations in the Donetsk and Luhansk regions.

agricultural enterprises (Fig. 1). In 2015, 98.9% of natural honey production was harvested in individual household apiaries by approximately 700,000 households (4.1% of the total)<sup>8,10</sup>. Production and processing practices are mostly traditional and diversified by households and regions, based on the local agri-food culture.

There are three ecological zones in Ukraine : mixed coniferous-deciduous forests, forest-steppe, and steppe zones. Honey bees (*Apis mellifera*) were adapted to the different ecological zones in the territory of Ukraine and diversified into three biotypes : Ukrainian steppe (*Apis mellifera sossimai* or *Apis mellifera acervorum*), Carpathian (*Apis mellifera carpatica*), and Polissia bees (*Apis mellifera mellifera*)<sup>11</sup>. The natural bee zoning scheme was developed in 2000, and facilitated the development and application of science based on the biological peculiarities, climatic conditions, and other regional factors<sup>12</sup>.

The main melliferous crops in Ukraine are sunflowers, buckwheat, and rapeseed. The total harvested area in 2015 was 5,918,800 ha (21.3 %) of a total of 27,801,300 ha of sown land. Pollination of agricultural crops was not regulated and only a few agricultural enterprises used bees for crop pollination. Ukraine's position in the world beekeeping market strengthened during the last decade, but recent military conflicts in the east of Ukraine and in the Autonomous Republic of Crimea, both of which were important beekeeping regions, negatively influenced the country's economy and agriculture. Honey and other products could be related to high-value products, the consumption of which tends to decrease when economic conditions in the country become unstable, which in turn can lead to an industry decline.

Honey production results in a high level of consumption in the given country and a growing export capacity. Export of natural honey was very low in 1992, though it increased dramatically after 2013. It was 36,013 tons, or 57% of total honey production, in 2015. The average amount of honey imported from 1992 to 2015 was 50 tons/year but generally, it was considered an unessential product (Table 1).

In order to understand how much of the available domestic honey supply had been imported and how much came from in-country production, the import dependency ratio (IDR) was calculated using the following formula :

**Table 1** Ukraine honey supply and trade from 1992 to 2015

	1992	1995	2000	2005	2010	2015
Production (t)	57,111	62,728	52,439	71,462	70,873	62,697
Export (t)	0.0	108	155	3,814	7,048	36,013
Import (t)	20	100	99	63	107	17
Honey supply (kg/capita/year)	1.1	1.2	1.1	1.4	1.4	0.6
Import dependency ratio (%)	0.04	0.1	0.2	0.1	0.2	0.06
Self-sufficiency ratio (%)	100	100	100.1	105.5	110.9	234.8

Source: State Statistics Service of Ukraine (2016)<sup>8</sup>

$$IDR = \frac{\text{Imports}}{\text{Production} + \text{Imports} - \text{Exports}} * 100$$

From 1992 to 2015, the IDR was very low (0.06–0.1), close to zero ; that confirms our hypothesis about Ukrainian honey self-sufficiency.

To determine the degree of production in relation to domestic utilization, the self-sufficiency ratio (SSR) was calculated using the formula proposed by the Food and Agriculture Organization.

$$SSR = \frac{\text{Production}}{\text{Production} + \text{Imports} - \text{Exports}} * 100$$

The calculated self-sufficiency ratio was above 100% in 1992, and in 2015, when the export capacity was at its highest (57%), the self-sufficiency ratio was also high (234.8%).

Ukrainian honey has been exported to various countries, but the main importers of honey were Germany, Poland, and the U.S. in 2015. A total of 38.3 tons of Ukrainian honey was exported to Japan for the first time in 2014 and this amount increased to 82.0 tons in 2017<sup>13</sup>.

## Research methods

### (1) Regional Typology

Statistical data from relevant institutions at the national and regional levels, such as the State Statistics Service of Ukraine (production in apiaries, number of bee colonies, land area, agricultural crops' arable area, honey and wax production, honey sales price by agricultural enterprises) and the Main Administration of Veterinarian Medicine (number of bee colonies) in 25 regions were used for analysis.

First, a statistical data analysis was conducted, after which a principal component analysis (PCA) was undertaken to combine and reduce the available datasets on regional production characteristics ; SPSS version 19 (SPSS, 2010, Chicago, IL, USA) was used. PCA was done on the 25 items for the 25 regions and the 11 variables with a direct oblimin rotation that were collected from all regions ; no data were lacking (Table 2). The Kaiser-

**Table 2** List of variables used for PCA analysis

Variables Group	PCA Variables
Production	Number of bee families in agricultural enterprises (1000 bee colonies)
Entities	Number of bee families in households (1000 bee colonies)
Honey	Total honey production by households (t)
Production	Total honey production by agricultural enterprises (t)
	Wax production by agricultural enterprises (t)
Land	Total arable land in the region (1000 ha)
Agricultural	Total buckwheat area in the region (1000 ha)
Melliferous	Total sunflower area in the region (1000 ha)
Plants	Total rape area in the region (1000 ha)
Honey	Honey sold price by agricultural enterprises (UAH/t)
Trade	Honey sold by agricultural enterprises (t)

Meyer-Olkin measure was used to verify the data-sampling adequacy for the analysis.

Hierarchical cluster analysis, with the application of Ward's method, was used to define the regional production clusters. The method generates, as a result, a broad picture with a well-defined combination of clusters that is easier to describe than when a different type of cluster analysis is used.

## (2) Consumption of Honeybee Products

Primary data used for honeybee products research were obtained from a survey of 204 individuals conducted in the form of personal in-home and street interviews in Shepetivka, Khmelnytskyi Oblast, and Kyiv ( $n = 46$ ), as well as online surveys ( $n = 158$ ) in September 2014. The questionnaire consisted of three parts : 1) respondents' social profile, 2) opinions on beekeeping and beekeeping commodities, and 3) willingness to pay (WTP) method, with 25 multiple-choice questions with four variants. WTP questions included questions used for a non-parametric approach for choice contingent valuation. Respondents' opinions on beekeeping and honeybee products focused on consumers' concerns about beekeeping and its importance, preference of beekeepers, and criteria used when buying honeybee products. A double-bound dichotomous choice contingent valuation method was used for research<sup>14)</sup>. Moreover, farm gate price of different types of honey were also collected from 32 household beekeepers in Khmelnytskyi Oblast in 2014.

## Results

### (1) Regional Typology

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, with  $KMO = 0.585$ , which is 'mediocre', according to Field<sup>15)</sup>. Bartlett's test of sphericity,  $\chi^2(45) = 600,264$ ,  $p < 0.001$ , indicated that correlations between items were sufficiently large for PCA. The total variance of three components explained 76% of the variance in the original data (Table 3).

The correlation of each of the variables in PCA is indicated in Table 4. The most significant correlations are shown in bold. The variables with significant correlation were grouped into three components, measuring the common underlying dimension. A high correlation of the sown area of sunflowers, the arable land area, the sown area of rapeseed, and honey sale price by agricultural enterprises would characterize the first component as production resources. The high correlation of the sown area of buckwheat, the amount of honey sold by agricultural enterprises, and the honey production by agricultural enterprises would characterize the second component as the agricultural enterprises' honey production feature.

**Table 3** PCA variance components loadings

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.79	43.5	43.5	4.79	43.5	43.5
2	2.37	21.5	65.1	2.37	21.5	65.1
3	1.23	11.2	76.3	1.23	11.2	76.3

**Table 4** Contribution rate of variables in PCA matrix

Variable	Component		
	1	2	3
Sunflower (1000 ha)	<b>0.940</b>	-0.130	0.042
Arable land (1000 ha)	<b>0.779</b>	0.198	0.156
Honey sales price by agricultural enterprises (UAH/t)	<b>-0.721</b>	-0.384	-0.077
Rape (1000 ha)	<b>-0.704</b>	0.414	0.457
Honey production by households (t)	0.565	-0.053	0.298
Buckwheat (1000 ha)	-0.220	<b>0.838</b>	-0.104
Honey sold by agricultural enterprises	0.354	<b>0.837</b>	-0.025
Honey production by agricultural enterprises	0.352	<b>0.485</b>	0.451
Number of bee families in h.h. (colonies)	0.001	-0.237	<b>0.934</b>
Wax production by agricultural enterprises	0.217	0.018	<b>0.770</b>
Number of bee families in agricultural enterprises (colonies)	-0.015	0.466	<b>0.648</b>

The third component in the matrix has the highest correlation by number of bee colonies in household apiaries, wax production by agricultural enterprises, and the number of bee colonies of agricultural enterprises.

The hierarchical cluster analysis with application of Ward's method and the interval measure of the squared Euclidean distance was applied, and results indicate that regions were capable of differentiating into the following three groups (Fig. 2) :

Cluster 1. Zakarpattia, Chernivtsi, Autonomic Republic Crimea (AR Crimea), Volyn, Rivne, Ivano-Frankivsk, Lviv, Ternopil ;

Cluster 2. Khmelnytskyi, Cherkasy, Vinnytsia, Kyiv, Chernihiv, Sumy, Kirovohrad, Poltava, Kharkiv ;

Cluster 3. Luhansk, Kherson, Donetsk, Zaporizhzhia, Mykolaiv, Odesa, Zhytomyr, Dnipropetrovsk.

The regional distribution by beekeeping cluster division is indicated in Fig. 3. The Cluster 1 regions are mostly situated in the west of the country. The natural conditions per region are characterized by the availability of large forest areas, mountains and highlands, wild vegetation, and natural resources. Cluster 2 includes the country's central regions and corresponds to forest-steppe and forest



natural zones with developed agriculture, except for regions in the north. Cluster 3 includes the southern areas of the country and one northern region (Zhytomyr) with highly developed agriculture and much agricultural land; regions in the east have heavily developed industry.

The combination of regional characteristics in Table 4 shows that the most obvious differences are the number of household and agricultural enterprise apiaries by region, honey price, melliferous plants dominance, and agricultural melliferous crops area.

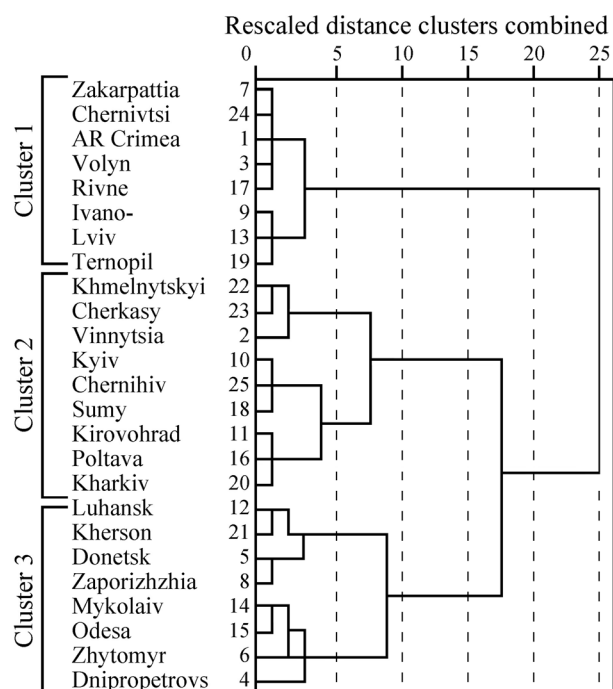


Fig. 2 Hierarchical cluster analysis of beekeeping regions of Ukraine

According to Table 5, mean arable land area by clusters increased reciprocally to the total land area. The ratio of agricultural enterprises and household apiaries bee colony numbers to total and arable land area were reciprocal to bee colony numbers by cluster. Sunflower was the largest sown area plant among the analysed melliferous crops. Honey and wax production were reciprocal to bee colony numbers by clusters. The characteristics of the three clusters can be summarized as follows. In the first cluster, the mean area and the area of melliferous agricultural crops planted were the smallest. Thus, both the number of bee colonies in agricultural enterprises as well as in household apiaries were the smallest. However, the price of honey sold by agricultural enterprises apiaries was the highest (39,271 UAH/t) among all the clusters. In the second cluster, there were the largest amount of bee colonies and the largest amount of honey produced in agricultural enterprises; however, the price of honey was

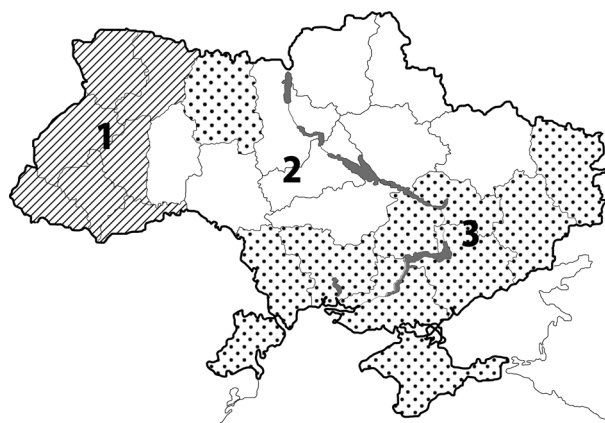


Fig. 3 Beekeeping cluster distribution in Ukraine  
Source : Based on Fig. 2

Table 5 Mean values for agricultural enterprises (a.e.) and household (h.h.) apiaries across the final beekeeping regions' three clusters

Cluster	1				2				3			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Land area (1000 ha)	1,708	549	809	2,608	2,629	390	2,062	3,190	2,856	275	2,458	3,331
Arable land area (1000 ha)	645	320	199	1,268	1,523	255	1,226	1,927	1,701	336	1,098	2,126
No. of bee colonies in a.e. apiaries	874	398	280	1,655	4,067	3,020	1,335	11,457	2,349	1,429	500	5,354
Ratio of a.e. bee colonies no. to arable land area	1.4				2.7				1.4			
Ratio of a.e. bee colonies no. to total land area	0.5				1.5				0.8			
No. of bee colonies in h.h. apiaries	37,794	21,015	6,713	64,091	69,394	31,350	37,914	120,500	95,704	544,512	24,317	174,900
Ratio of h.h. bee colonies no. to arable land area	58.6				45.6				56.3			
Ratio of h.h. bee colonies no. to total land area	22.1				26.4				33.5			
Area of sown rape (1000 ha)	21	15.7	0.6	45.7	30.6	14.8	8.6	52.6	12.9	9	0.9	26.6
Area of sown buckwheat (1000 ha)	5.3	5.5	0.4	17.2	20.5	9.5	6.8	36.5	5.9	4.2	1.2	13.4
Area of sown sunflower (1000 ha)	14.1	21	2.6	69.2	195.7	139.6	40.1	481.6	401	154.6	47.2	595.1
Index of melliferous plants sown area (rape, buckwheat, sunflower) to arable land	6.3				16.2				24.7			
No. of wax production in a.e. apiaries (t)	0.2	0.1	0	0.5	0.8	0.5	0.1	1.8	1	1	0	3.4
No. of honey production in a.e. apiaries (t)	12.7	4.2	7.9	19.5	93.5	36.8	30.9	148.9	59.2	50.2	10	179.7
A.e. honey productivity (kg/bee colony)	14.5				23				25.2			
No. of honey production in household apiaries (t)	932	772	185	2,865	2,475	1,169	523	4,830	4,872	26,212	1,436	10,190
H.h. honey productivity (kg/bee colony)	24.7				35.7				50.9			
Index of honey produced per area (t/ha)	0.6				1				1.7			
No. of honey sold in agricultural enterprises	0.2	0.2	0	0.4	3.1	1.2	1.1	5.2	1.1	0.9	0.2	3.4
Honey sale price in agricultural enterprises apiaries (t)	39,271	8,012	28,760	51,419	23,519	4,169	14,110	28,509	24,145	5,809	17,519	35,412

Source: Calculation based on the State Statistics Service of Ukraine (2013)

the lowest (23,518UAH/t, only 60% of the highest). In the third cluster, the mean area was the largest, and the largest area of melliferous crops was sown. The number of bee colonies in household apiaries by oblast exceeded the second cluster, and the bee honey productivity was the highest.

## (2) Consumption of Honeybee Products

A total of 204 people were surveyed during the research, of which 35% were male and 65% female. Respondents were citizens of Ukraine and lived in different regions of Ukraine.

Most of the respondents lived with their families (76%) and only 17% lived alone. The largest group of respondents were company employees (32%) and state officers (28%), followed by other activity (12%), pensioners (7%), studying (6%), did not work (2%) and only one person was a farmer. Monthly expenses of interviewees were distributed in a range from 500UAH per month to more than 10,000UAH per month. Most of the respondents did not have an apiary and bought honey for their consumption.

The honeybee products commodity survey showed that the most popular product was honey, however, people consume various types of products such as bee pollen, honey mixes, honey drinks, infusion, etc. (Table 6). Most of the respondents were aware of the benefits of honey on their health (the average answer was 4.8 out of 5, when '5' means 'I think so' and '1' means 'I don't think so') and its deliciousness (4.7). Regarding consumers' awareness of the positive impact of beekeeping on the environment and nature, 79% of respondents strongly agreed with such a statement (4.7). The distribution of respondents'

**Table 6** Frequency of consumed bee products by types

Types of bee products	%
Honey	96.1
Pollen	23.0
Honey mixes <sup>1)</sup>	22.5
Honey drinks	17.2
Infusions <sup>2)</sup>	17.2
Royal jelly	11.3
Bee bread	6.9
Zabrus <sup>3)</sup>	5.4
Other <sup>4)</sup>	11.3

Source: Authors survey (n=204) in 2014

<sup>1)</sup> Nuts and dried fruit macerated in honey.

<sup>2)</sup> 20-40% alcohol drink in which honey is mixed with alcohol and sometimes plant leaves, and left for 2-3 weeks to subsume.

<sup>3)</sup> Honey combs wax caps with honey, which is cut before honey extraction from the frames.

<sup>4)</sup> Propolis, bee venom, wax moth or dead bee infusion (moth insect and alcohol).

answers on honey prices showed that low-income people recognized that honey was expensive on the Ukrainian market (3.4), while most of the respondents answered that honey was 'somewhat' or 'maybe' expensive. A total of 58% of respondents considered beekeeping as a possible source of income.

It was interesting to show that 87% of respondents preferred commodities produced by household apiaries, 12% answered that they preferred agricultural enterprise honey, and 1% honey retailing companies. At the same time, 85% of respondents answered that there was an available beekeeper among their friends or neighbours, from whom they could buy or receive bee products. Only 15% of respondents had no access to such producers.

In order to build an appropriate marketing strategy for beekeepers, it is important to know what is driving consumers to buy beekeeping products. Respondents' judgments were grouped into five criteria : production area, honey variety, producer, production time, and quality certificate. The most important factor was the producer (average answer rate 4.6), followed by production time (4.4), production area (4.3), and honey variety (4.1). The least important was the availability of a quality certificate for the produce (3.2).

Table 7 shows the result of the WTP survey, consumers' acceptance rate, and presented price for multifloral wild honey. In the interview, respondents were asked the following question :

'Which honey would you buy if the price of multifloral wild honey per 1 kg is XUAH, and monofloral cultural honey price per 1 kg is 60UAH?'

Choice 1 : Monofloral honey (60UAH/kg)

Choice 2 : Multifloral honey (XUAH/kg), where 'X' is 'presented price' in Table 7.

Analysis showed that the WTP level was 93.6UAH and 1.56 times higher than the price of monofloral cultural honey.

The farm gate price of honey differed according to the

**Table 7** Presented price and acceptance rate on WTP survey

Presented price (UAH)	Acceptance rate
65	0.90
70	0.86
75	0.76
80	0.68
90	0.68
100	0.65
110	0.62
WTP	93.6

Source: Authors' survey (n=204) in 2014

Note:1000 Japanese Yen (JPY) equivalents to 80.24

Ukrainian hryvnia (UAH) (National Bank of Ukraine, 2014)

**Table 8** Household beekeepers' farm gate price of honey  
Unit: UAH/kg

Type of honey			Average	SD	Min.	Max.
Monofloral	crop	Sunflower	38.0	3.3	35.7	42.9
	crop	Rape	38.0	3.3	35.7	42.9
	crop	Buckwheat	39.3	2.9	35.7	42.9
	Tree	Linden	44.1	2.4	41.0	50.0
	Tree	Acacia	44.4	2.9	41.0	50.0
Multifloral	Normal multiflora		38.5	3.3	35.7	42.9
	Wild		39.4	3.3	35.7	45.7
	May*		41.1	3.2	35.7	50.0

\* Honey collected from the firstly flowered multiflora in May.

Source: Data obtained by interview from 32 household beekeepers in Khmelnytskyi in 2014

Note: 1000 Japanese Yen (JPY) equivalents to 80.24

Ukrainian hryvnia (UAH) (National Bank of Ukraine, 2014)

floral source (Table 8). Monofloral crop honey (sunflower and rapeseed) garnered the lowest price (38.0 UAH), and monofloral tree honey (linden and acacia) the highest (44.1 and 44.4). In actuality, multifloral honey is not much different from crop honey; however, consumers may be willing to pay more, according to the results of the WTP analysis.

## Discussion

Prior studies of Ukrainian beekeeping concentrated mainly on production and bee health, while beekeeping management and marketing remained insufficiently investigated. It is important for rural areas to improve beekeeping as a strong source of income<sup>16)</sup>. Research into beekeeping management mostly concentrated on the operations and economics of agricultural enterprise apiaries, and the situation in household apiary production has not been sufficiently researched. The production of beekeeping commodities in Ukraine is mainly fulfilled by both household and enterprise apiaries, with diverse production practices, the wide distribution of honey bees, and variable flower vegetation to produce a wide range of honey types.

The research was conducted using available secondary data from the national and regional agencies. Because the number of available data categories is limited, the primary step in differentiating Ukrainian beekeeping by type revealed the existence of three distinct regions. It is important to apply different approaches when developing and implementing the industry's measures of improvement. Simultaneously, traditional home-based production should be improved to manage risk for the household economy, conserve the ecosystem services, and maintain the biocultural diversity and agri-food culture in the regions. Future studies will need to analyse the household management of honey production.

Even though WTP was high and consumers were ready

to pay more for high quality produce, prices on the domestic market were lower. This could be explained by the fact that Ukraine is fully self-sufficient with domestic honey and the situation on the global honey market does not significantly influence the domestic market.

To improve the analysis, it could be effective to conduct a survey and collect primary data from all regional producers and combine it with available secondary data. The lack of previous research on beekeeping typology using different data categories in Ukraine makes this study the first step in developing the topic. Therefore, future studies could improve the study methodology and data categories.

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# ウクライナにおける養蜂の地域類型と ミツバチ製品の消費の特徴

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**要約：**ウクライナは 1000 年以上にもわたる養蜂の歴史があるが、その発展過程でさまざまな課題があった。独立後のウクライナの経済危機下で、各家庭の養蜂生産は重要な収入源として拡大し、2015 年には全蜂蜜生産のうち 98.9% が家族養蜂場で収穫された。全家庭の 4.1% が養蜂を行っていることになる。養蜂とミツバチ製品の加工は伝統的であり、地域の食農文化に基づいて多様に分化している。国内 25 地域から 11 変数を用いて、主成分分析とクラスター分析を行い、生産環境と養蜂条件の地域特性を明らかにした。主として西部のクラスター 1、中部のクラスター 2、および南東部のクラスター 3 の 3 つが定義された。クラスター 1 は、森林や野生植生が多く、農用地面積と家族養蜂場は少ないが、企業養蜂場の蜂蜜の価格は高い。クラスター 2 は森林ステップ地帯で農業生産が盛んである。企業養蜂場の蜂蜜生産量は最大であるが、価格は低い。クラスター 3 は農業および工業の発達した地帯で、蜜源作物の面積が大きいため、蜂蜜の生産性は最も高い。地域によってそれぞれリスク管理、生物文化多様性の維持、食農文化の維持、生態系サービスの強化などによる養蜂環境改善のためのアプローチが必要であることが示された。ミツバチ製品の消費者行動調査では、ハチミツだけでなく、さまざまな種類の製品を消費していることがわかった。回答者の 85% が家族や友人からの製品を入手することができ、多くは企業養蜂場より家族養蜂場の製品を好んでいることが明らかとなった。消費者は、養蜂家から得られる蜂蜜の生産地域、蜂蜜の種類に関する直接的な情報を信じており、蜂蜜品質の認証を重視していなかった。

**キーワード：**養蜂、消費行動、ハチミツ、主成分分析、地域類型

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